4.0 ENVIRONMENTAL CONSEQUENCES OF PROPOSED ACTION AND ALTERNATIVES

This section describes in detail the potential effects of the alternatives considered in this EA. Effects are organized by the alternatives discussed in Section 2 and are described for the specific resource areas that were discussed in Section 3. Effects of the cable route, cable specifications, cable installation, and operations and maintenance are analyzed.

The potential effects of the project on environmental resources and marine activities include temporary interference with navigation, fishing, and other marine activities and disturbance of marine resources. Disturbances would be localized along the proposed cable routes, and potential effects are expected to occur only during installation of the cable (Earth Tech 1999).

Once the cable has been installed, operations and maintenance activities are not expected to be required within the sanctuary. The fault rate assumption by the applicant's maintenance providers for the entire 12,124 km Hibernia Project is from 1.58 to 2.58 faults per year. Application of the high-end figure yields an expected number of approximately 0.005 faults along the cable segment within the Stellwagen Bank NMS, or one fault every 200 years (360networks, inc. 2000a).

The primary threat to submarine cables is bottom fishing, and the fault rate considers both buried and unburied cables, although the majority of faults affect unburied cable. The applicant therefore considers the quoted fault rate for the Stellwagen Bank NMS to be a conservative estimate (360networks, inc. 2000b). The likelihood of a need for any operations and maintenance activities occurring within the Stellwagen Bank NMS during the expected life of the cable is very remote. Potential environmental effects of operations and maintenance activities therefore are discussed only briefly.

4.1 PREFERRED ALTERNATIVE

This section describes the environmental impacts of the Preferred Alternative to the water; geologic; biological; cultural and historical; and socioeconomic resources of the Stellwagen Bank NMS.

4.1.1 Water Resources

Cable Route

As discussed in Section 3, the proposed route avoids areas of known contamination. Therefore, it is not expected that significantly contaminated soils would be encountered along the proposed route, and effects on water resources caused by the route selection would be minimal.

Cable Specifications

The cable is constructed of optical fibers surrounded by a copper conductor and steel strength members and contained within a polyethylene tube that should prevent any leaching of metals into the environment. The cable is armored by steel wires and coated with a compound produced from pine tar. The compound contains no petroleum-based products and does not decompose or break down. Therefore, once installed, the buried cable would not produce any subsequent alterations in suspended sediment or water turbidity

levels. No long-term effects on water quality as a result of the degradation of the cable system are anticipated.

Cable Installation

Temporary, minor, local effects on water quality from discharges of sanitary waste, bilge water, minor fuel oil spills, and general debris could occur because of the operation of ships during installation of the cable. Installation of the cable through the Stellwagen Bank NMS would take less than two days. It is not expected that it would be necessary to discharge sanitary waste from ships into the ocean during such a short time. It is possible that normal ship operations could cause the discharge of minor amounts of petroleum products to the water during such a period. However, vessels would operate in accordance with the regulations of the U.S. Coast Guard (USCG) and other applicable regulations, in a manner similar to the operations of any other commercial vessel in U.S. waters.

The temporary disturbance of sediments caused by installation of the cable should have no significant effect on water quality and should cause no harm to marine biota from increased levels of toxicants. Because of the use of sea plow technology, rather than the more traditional cut-and-cover technology, disturbance of the sea bed and any potentially contaminated sediments would be minimal and temporary. Activities typically associated with dredging operations, such as suspension, side-casting or permanent removal of sediment, would be avoided. The slow speed of a ship plowing and installing cable would minimize sediment disturbance further and prevent potential ship collisions that could cause contaminants such as petroleum products to enter ocean waters.

Operation and Maintenance

Once the cable has been installed, operation of the cable should not have any effects on water quality. In the unlikely event of a cable fault (see the discussion of probability set forth above), repair operations would necessitate unburying the cable in the vicinity of the damage and bringing it to the surface for repair. After repair, the cable would be reburied by a remotely operated vehicle. Section 2 of this document presents a more detailed description of cable repair activities. Repair operations would cause temporary sediment disturbance of sediment, suspension of sediment in the water column, and disturbance of benthic communities.

4.1.2 Geologic Resources

Cable Route

Since regulations prohibit drilling and dredging activities within the boundaries of the sanctuary, there would be no effect on the extraction of mineral or gas resources. In addition, the lack of historical exploratory drilling or interest on the part of oil and gas companies indicate that it is unlikely that any interest in such activities be undertaken during the life of the project.

The proposed route avoids areas of known contamination, such as those discussed in Section 3. Therefore, it is not expected that significantly contaminated soils will be encountered along the proposed route; effects on geologic resources as a result of route selection would be minimal.

Review of the data obtained by side-scan sonar and subbottom profiler for the Preferred Alternative route did not reveal any bed forms indicated by current, such as megaripples, sand waves, or current scour. Therefore, no long-term hydrographic events are expected to affect the cable once installation has been completed. Normal seasonal currents currently affect the sediments of the sea floor, but those currents have shown no mass removal of sediment that would even suggest the possibility that the cable might be exposed. The 19.49 km of cable in Stellwagen Bank NMS would be placed at a depth of 60 m, well below any wave effects in the area. No significant events, such as hurricanes or 100-year storms, should affect the sediments on the sea floor in a manner that would expose the cable (360networks, inc. 2000a).

For the Preferred Alternative route, the cable would be buried in the softest bottom types to avoid unnecessary effects on the environment. Table 4-1 shows bottom types affected by length and percentage of the total Preferred Alternative route.

Table 4-1: Bottom Types Along the Preferred Alternative Route

Bottom Type	Length of Preferred Route		Segment within SBNMS	
	Length (km)	Percent	Length (km)	Percent
Gravel (Mixed Course)	18.8	16	3	14
Sand	19.3	17	7.291	35
Mud	40.2	35	1	5
Mud (silt/clay)	37	32	9.5	46
Total	**115.3**	**100**	**20.791**	**100**

Source: Seafloor Surveys International, Inc. 1999. Note that the total length listed reflects a small segment where the route would briefly leave the Sanctuary and then re-renter. When not included, the total length of the Preferred Alternative route would be 19.49 km.

Cable Specifications

The cable is constructed of optical fibers surrounded by a copper conductor and steel strength members and is to be contained within a polyethylene tube that should prevent any leaching of metals into the environment. The cable is armored by steel wires and coated by a compound produced from pine tar. The compound contains no petroleum-based products and does not decompose or break down. Therefore, no long-term effects on to sediment quality resulting from the degradation of the cable system are anticipated.

Cable Installation

The project would involve the temporary disturbance of sediments on the ocean bottom to plow a 1 m wide by 1.5 m deep wedge in the sediments to bury the cable. The width of the sea plow mechanism is 4.6 m, including the skids. The skids generally "float" on the surface of the sea bed, rather than disturbing it. During plowing operations, only the plowshare itself impacts the sea bed. Only during times when the plowshare is not in operation would the entire sea plow rest on the sea bed. Therefore, during installation the width of the disturbed area would be the width of the plowshare (1.5 m deep and 1.0 m wide, by 19.5 km, or a total of approximately 4.8 acres of disturbed sea bed) (360networks, inc. 2000a).

Installation of the cable should cause only minor and localized temporary suspension of sediment along the cable route, since the ship towing the plow would travel at a speed of only 0.5 to 1 knot and the area that would be disturbed is narrow. The sediment that would be disturbed would be displaced sideways and upward but would fall back into the trench immediately after the plow passes and the cable is inserted

into the trench. As the sediments are disturbed, any contaminants bound to the sediments could be resuspended temporarily. The temporary disturbance of sediments caused by installation of the cable should have no potential significant effect on sediment or water quality and should cause no harm to marine biota as the result of increased levels of toxicants.

Operation and Maintenance

A review of the detailed marine surveys of the project corridor indicates that no long-term hydrographic events would affect the cable once installation has been completed. The normal seasonal currents that currently affect sediments of the sea floor have shown no mass removal of sediment that would suggest that the cable might become exposed. Significant events, such as hurricanes or 100-year storms, should not affect the sea floor sediments in a manner that would expose the cable.

The storm of record in the area is the Halloween Storm of 1991. Examination of bathymetric charts from both before and after that storm indicates that the sea floor did not change to any significant degree. The depth of water, coupled with the depth at which the cable will be buried, should ensure that the cable would remain buried under such conditions.

4.1.3 Biological Resources

The potential effects of the Preferred Alternative on biological resources in the vicinity of the project area are described below. The resources discussed correspond to those presented in Section 3 and include fish; benthic communities; marine mammals, reptiles, birds; and plankton. The effects on each resource are presented as above, by cable route, specifications, installation, and operations and maintenance.

4.1.3.1 Fish

Cable Route

Demersal fish present that inhabit the cable route lay their eggs in the fall or early winter, and hatching usually occurs before spring. Installation of the cable on the U.S. portion of the route is expected to take place spring or summer 2000, after the eggs have hatched, thereby eliminating any direct effects, such as displacement of eggs.

Cable Specifications

Once installed, the buried cable will have no effect on fish species in the area.

Cable Installation

The habitat of both eggs and adults of the species of demersal fish found in the area would be disturbed temporarily during the plowing of the 1 m wide by 1.5 m deep wedge in the sediments to bury the cable. The result should be only minor and temporary disturbance of sediment and any bottom-dwelling fish or the eggs of those fish along the route. The sediment that would be disturbed would be displaced sideways and upward, but would fall back into the trench immediately after the plow passes and the cable is inserted into the trench. The alteration of other aspects of the habitat of demersal fish species, such as loss

of prey, would be local and temporary and is not expected to have any measurable effect on populations of demersal fish species. Temporary displacement of some fish from the immediate vicinity (that is, tens of feet) of the cable route would occur during operation of the plow. Those impacts also would be of a temporary and local nature.

Pelagic fish should not be affected significantly by installation of the cable. Installation of the cable would take less than two days. It is not expected that any minor pollution effects from the operations of ships would affect those fish species.

Operation and Maintenance

Because the cable is buried permanently, the cable itself, as well as operation of the cable, would have no long-term effects on demersal or pelagic fish species, their reproduction, or their habitat. In the unlikely event that maintenance would be required, repair operations would necessitate unburying the cable in the vicinity of the damage and bringing it to the surface for repair. After repair, the cable would be reburied using a remotely operated vehicle. Repair operations would cause temporary sediment disturbance and sediment suspension in the water column.

4.1.3.2 Benthic Communities

Cable Route

Because of the geologic characteristics along the Preferred Alternative route, the benthic communities present are those associated with soft-bottom areas.

Cable Specifications

Since the cable would be buried at a depth of 1.5 m, once installed it would not have effects on benthic organisms present in the project area.

Cable Installation

Environmental effects on benthic communities in Stellwagen Bank NMS would result from operation of the plow. The project would involve the temporary disturbance of ocean bottom sediments while plowing a 1 m wide by 1.5 m deep wedge in the sediments to bury the cable. The width of the plow is 4.6 m, including the skids. The skids "float" on the surface of the sea bed, rather that disturbing it. Therefore, the width of the disturbed area would be the width of the plowshare (1.5 m deep and 1.0 m wide, by 19.5 km, or a total of approximately 4.8 acres of disturbed sea bed) (360networks, inc. 2000a).

During installation of the cable, sedentary and slow-moving benthic organisms would be injured and killed. The plow blade may contact such organisms, and the wheels of the plow may crush some individuals. More mobile benthic species, such as groundfish, lobsters, and crabs, would be expected to avoid direct contact by moving out of the way of the sea plow (NMFS 2000, Earth Tech 1999).

Because the amount of disturbance of soil required for installation is minimal and the disturbed area would be restored immediately to preinstallation conditions, effects on the marine environment would be minimal. In addition, installation of the cable progresses slowly, at a rate of approximately 0.5-1.0 knot,

thereby limiting the potential that the plow would affect benthic habitats adversely. Given the narrow area of temporary disturbance of sediment, it is anticipated that much of the benthic infauna and epifauna would recolonize the area in which the cable was laid within a matter of weeks or months. In some cases, recolonization would not occur until the next spawning season.

Operation and Maintenance

It is not expected that, after installation of the cable, the project will affect marine resources or activities because the cable would be buried to a depth of approximately 1.5 m beneath the sea bed. The location of the route also would be charted to alert mariners to the presence of the cable.

Operation of the cable should not have any effects on the benthic community. In the unlikely event of a cable fault, repair operations would necessitate unburying the cable in the vicinity of the damage and bringing it to the surface for repair. After repair, the cable would be reburied by a remotely operated vehicle. Repair operations would cause temporary disturbance of sediment, suspension of sediment in the water column, and disturbance of benthic communities.

4.1.3.3 Marine Mammals

Potential effects on marine mammals include ship strikes during installation, entanglements during deployment of the cable, and disturbances caused by induced electrical fields (NMFS 2000; 360networks,inc. 2000b).

Cable Route

The Stellwagen Bank NMS provides important feeding habitat for a number of marine mammal species. Marine mammals are also known to feed and nurse in the project area and to migrate through it.

Cable Specifications

Since the cable would be buried at a depth of 1.5 m, once installed, it would not have effects on any marine mammals in the project area.

Cable Installation

Any effects from the cable-laying ship likely would not differ from those of other vessel traffic common throughout the region. It is possible that the cable-laying ship might collide with a marine mammal along the cable route or that a marine mammal might become entangled in the cable during installation. However, it is likely that the speed of the ship during cable-laying activities would be slower than that of migrating whales or seals. NMFS concluded that, as long the speed of the cable ship during installation was no more than 1.0 knot, the Preferred Alternative would not be likely to adversely affect endangered whales that may be present in the project area (NMFS 2000).

The potential for disturbance of marine mammals as a result of induced electrical fields was evaluated and found to be insignificant. The electrical field induced around the cable is proportional to the rate of change of current flowing through it. Since the cable carries direct current (DC) only, there is no rate of

change of current, so there is no electric field around the cable, except when the cable is powered up or down. The power-up procedure typically takes several minutes, so the induced electric field is negligible.

For the Hibernia system, the current is 0.4 amplitudes (amp) for the initial system. Ultimately, it would not exceed 0.7 amp, which is less than many household appliances (for example, a typical toaster draws 12 amps).

The intensity of the magnetic field at a distance of 1 m from the cable with a 0.7 amp current will be 0.14 micro-tesla. The intensity of the naturally occurring magnetic field at the surface of the earth ranges from 300 micro-teslas at the equator to 600 micro-teslas at the poles. Therefore, the magnetic field at a distance of 1 m from the cable is more than 2,000 times less intense than the naturally occurring magnetic field of the earth (360networks 2000b).

Operation and Maintenance

In the unlikely event of a cable fault, it might be necessary to apply an electroding signal to the cable to locate the fault. If an electroding signal were applied to the cable, a low-level AC signal would be generated, with a frequency in the range of 15 to 25 hertz (Hz) for the short time period necessary to locate the fault.

After the cable has been installed, entanglements of marine mammals would be highly unlikely because the cable is to be buried along its entire proposed route. NMFS concluded that the Preferred Alternative would not be likely to adversely affect endangered whales that may be present in the project area if the cable is to be buried to a depth of 1.5 m beneath the sea bed. NMFS also recommended that post-deployment surveys be conducted within 30 days of the installation of the cable, and again four years after installation, to document that target depths of deployment were reached (NMFS 2000).

4.1.3.4 Marine Reptiles

Marine reptiles could be affected by the Preferred Alternative in a number of ways. Ship strikes could occur during installation of the cable and entanglements could take place, both during deployment of the cable and after installation, if any portion of the cable that is unburied (NMFS 2000).

Cable Route

The Stellwagen Bank NMS provides important feeding habitat for a number of species of marine reptiles. Marine reptiles are also known to feed and nurse in the project area and to migrate through it.

Cable Specifications

As the cable would be buried at a depth of 1.5 m, once installed it would not have effects on marine reptiles in the project area.

Cable Installation

No temporary or permanent effects on marine reptile populations are likely or expected as a result of installation of the fiber-optic cable, which would not affect habitat of those populations. There is a slight

potential that marine reptiles might become entangled in the ship lines during installation of the cable, or collide with the vessel performing the installation. However, the lines are maintained fairly taut and entanglement is unlikely. The potential for ship strikes and entanglements during deployment would also be reduced by the slow speed of the ship during installation. It is proposed that the deployment speed would be between 0.5 and 1.0 knot.

Operation and Maintenance

No temporary or permanent effects on marine reptile populations are likely or expected as a result of operation of the fiber-optic cable, which would not affect the habitat of those populations.

After installation of the cable, the potential for entanglements would be eliminated because the cable is to be buried along its entire proposed route. It is recommended that post-deployment surveys be conducted within 30 days after installation of the cable, and again four years after installation, to document that target depths of deployment were reached (NMFS 2000).

4.1.3.5 Marine Birds

Cable Route

The Stellwagen Bank NMS provides important feeding habitat for a number of species of marine birds. However, no effects on the feeding habitat of those species would be expected under the Preferred Alternative.

Cable Specifications

Since the cable is to be buried at a depth of 1.5 m, once installed, it would not have any effects on marine birds in the project area.

Cable Installation

No permanent effects on populations of marine birds are likely or expected as a result of installation of the fiber-optic cable. The cable is to be installed at sufficient depth that the temporary disturbance would not influence the feeding activities of either surface-feeding or diving bird species, in terms of both their spatial feeding area and their prey. Many such birds are adapted to frequenting areas used by fishing and other vessels. The presence of additional vessels during the short installation period therefore would not have a negative effect on their abundance.

There would be no temporary or permanent effects on the one federally listed endangered bird species, the Roseate tern. The recovery plan for the tern focuses on protecting breeding colonies, but availability of prey may limit population recovery by the species. The proposed project is not expected to have an effect on the availability of prey, and therefore would have no effect on the species. However, if the cable were to be installed during the months of August or September, which is the period during which the Roseate tern prepares for migration, the FWS must be advised (FWS 1999).

No mitigation measures are necessary because there will be no temporary or permanent effects on marine birds as a result of installation of the fiber-optic cable in the Stellwagen Bank area.

Operation and Maintenance

No permanent effects on marine bird populations are likely or expected as a result of operation or maintenance of the fiber-optic cable.

4.1.3.6 Plankton

Cable Route

The Stellwagen Bank NMS provides important habitat for a number of species of zooplankton and phytoplankton. However, no effects on the habitat of those species would be expected under the Preferred Alternative.

Cable Specifications

Since the cable would be buried at a depth of 1.5 m, once installed, it would have no effects on any species of plankton in the project area.

Cable Installation

No temporary or permanent effects on populations of phytoplankton or zooplankton are likely or expected as a result of installation of the fiber-optic cable. The cable is to be installed at sufficient depth that the temporary disturbance will not influence the distribution or abundance of plankton. No mitigation measures are necessary, since there will be no temporary or permanent effects on plankton as a result of installation of the fiber-optic cable in the Stellwagen Bank NMS.

Operation and Maintenance

No temporary or permanent effects on populations of phytoplankton or zooplankton are likely or expected as a result of operation and maintenance of the fiber-optic cable. No mitigation measures are necessary, since there will be no temporary or permanent effects on plankton as a result of operation and maintenance of the fiber-optic cable in the Stellwagen Bank NMS.

4.1.4 Socioeconomic Resources

The potential effects of the Preferred Alternative on the socioeconomic resources of the region are described below. The resources described correspond to those presented in Section 3: commercial fishing, commercial shipping and navigation, whale watching, recreational fishing, bird watching, boating, and diving.

4.1.4.1 Commercial Fishing

Cable Route

Under the project, there is no plan to request an "exclusion zone" around the cable in which use of traditional fishing methods (including trawls, long lines, gillnets, and pots) would be restricted. The cable route would be marked on marine charts, and fishermen would be warned to avoid the cable (360networks, inc. 2000a).

Cable Specifications

To avoid interference with important commercial fisheries and fishing gear, the cable would be armored for protection against breakage and buried to 1.5 m. Since the cable would be buried to the 1,500 m contour for protection against existing and future fishing activity, it would not be a significant threat to boat anchoring or use of most fishing gear, such as bottom-set long line, gillnets, and lobster pots and traps.

The proposed cable would be protected from contact with fishing gear by armoring and burial in the sea bed. Further, fishermen would not be held liable if they damage the cable (whether the damage occurs during the cable's operational life or after abandonment) while using traditional fishing methods and gear, unless such damage is intentional or egregious. In addition, should a fisherman's gear become snagged on the cable and be sacrificed, the applicant would reimburse the fisherman for the gear, provided that timely notice is given and that appropriate evidence is provided to show that the gear was sacrificed to avoid further damage to the cable (Earth Tech 1999).

Cable Installation

During installation of the cable through the Stellwagen Bank NMS, the applicant would take a number of actions to ensure that commercial fishing vessels, as well as other users of the sanctuary are fully aware of the installation. Such actions include:

- Deploy patrol vessels in high-traffic areas
- Conduct a public awareness program (initially undertaken in the initial stages of the project - would continue after installation)
- Formal notices to mariners
- Air VHF broadcasts during installation period
- Publish notices of interest to commercial and recreational fishermen in appropriate periodicals
- Provide representatives of fishing interests with opportunities to be present on board the installation vessel (as was done during the route survey)

If NOAA approves an authorization and a special use permit for the Preferred Alternative, the applicant hopes to begin installation in June 2000 to accommodate fisheries by avoiding the main lobster season (360networks, inc. 2000a).

The installation of the cable line could affect fishing gear used in the area's commercial fisheries. Installation itself would take less than two days, so it should not interfere significantly with active fishery operations. Pelagic fisheries along the cable route that could be affected by the scheduling of the installation are active primarily from May through December. There is a remote potential for fishing boats to collide with the installation vessel.

As a mitigation measure, fishermen would be notified before installation begins to avoid damage to their gear during the installation. To do so, liaisons with the fisheries associations would be established to aid in communication with the fishing industry. During the installation period, the installation vessel would conform to appropriate rules of navigation to avoid collisions with fishing vessels.

Operation and Maintenance

Bottom-trawling is the fishing method most likely to be affected by the cable, because its use is widespread and it entails a high level of effort. Further, the nature of trawling gear entails a risk of entanglement, and the method involves penetration of the sea bed. Trawling gear penetrates, on average, 5 to 20 cm into the ocean bottom, and can be up to 55 m in width, affecting a large area. Usually tows are conducted at known productive fishing grounds that have been charted, and follow a narrow-range depth contour along the prevailing current pattern. Except during times of regulatory closures, trawl fishing is especially heavy on Jeffrey's Ledge, Stellwagen Bank, and Georges Bank, but it occurs in all areas of the central Gulf of Maine at some time each year.

4.1.4.2 Commercial Shipping and Navigation

Cable Route

While commercial shipping does take place in the vicinity of the Stellwagen Bank NMS, the Preferred Alternative route is expected to have no significant effect on commercial shipping because the route lies well north of established commercial shipping lanes.

Cable Specifications

Since the cable would be buried at a depth of 1.5 m, once installed, it would not have any effects on commercial shipping activities in the project area.

Cable Installation

No significant effects on commercial shipping are expected. The installation of the cable would take place over a period of less than two days and should not interfere with commercial shipping lanes.

While oil spills that result from collisions of vessels are always a threat, the implementation of the Vessel Traffic Separation Scheme has minimized the potential for such collisions. Of 105 vessel casualties in the period from 1984 through1988, 93 percent involved fishing vessels, and only two (less than two percent) involved commercial shipping vessels (NOAA 1993, cited in Earth Tech 1999). Given the volume of commercial ship traffic in the area, there is little potential for collisions in general, and the prospect of a significant spill caused by collisions between usual traffic and the cable installation vessel during the cable installation period is even more remote.

During installation of the cable in the Stellwagen Bank NMS, the applicant would take a number of actions to ensure that commercial shipping organizations are fully aware of the installation. Such actions will include:

- Deploy patrol vessels in high-traffic areas
- Conduct a public awareness program (initially undertaken in the initial stages of the project - would continue after installation)
- Formal notices to mariners
- Air VHF broadcasts during installation period
- Publish notices of interest to commercial and recreational fishermen in appropriate periodicals
- Provide representatives of fishing interests with opportunities to be present on board the installation vessel (as was done during the route survey)

To maintain the security of the cable-laying operation at the stern of the ship, it is possible that commercial vessels may be hired to prevent other boats from intruding into the area. Otherwise, cable-laying is a specialized field, and it is unlikely that the local labor force would be used. Similarly, the cable-laying ship is self-contained; therefore, ancillary facilities and support for a work force, such as temporary housing and locally supplied food and clothing, are not needed.

All appropriate navigation regulations and precautions would be followed to ensure that commercial vessels are not impeded during the short period of cable installation.

Operation and Maintenance

Operation of the cable would have no effect on commercial vessels because the cable is to be buried beneath the sea bed. Performance of maintenance activities would be preceded by notification of commercial shipping industries.

4.1.4.3 Whale-Watching

Cable Route

The Stellwagen Bank NMS provides important habitat for a number of species of whales. Consequently, vessels of the whale-watching industry frequently visit the sanctuary. However, the Preferred Alternative route lies well north of the sites of most whale-watching operations in the Stellwagen Bank NMS, and is therefore expected to have no effect on the whale-watching industry.

Cable Specifications

Since the cable would be buried at a depth of 1.5 m, once installed, it would have no effect on the whale-watching industry in the project area.

Cable Installation

Installation of the cable is not expected to have any significant effect on whale-watching in the sanctuary, even if installation takes place in the primary whale-watching season, from May through July. In areas in which marine activity is heavy, it is possible to install a cable by working closely with other mariners and requesting a small (2-mile) moving corridor around the cable ship in which ship traffic is restricted.

Operation and Maintenance

Operation of the cable is expected to have no effect on the whale-watching industry. In the unlikely event that cable maintenance becomes necessary, the performance of maintenance activities would be preceded by notification to all mariners.

4.1.4.4 Recreational Fishing

Cable Route

The applicant does not intend to request a widespread fishing exclusion zone around the cable, and the cable would not interfere with usual fishing practices because it would be buried along its entire route through the Stellwagen Bank NMS (360networks, inc. 2000a).

Cable Specifications

The cable would be armored for protection against breakage and buried deeply. Since the cable would be buried to the 1,500 m contour for protection against existing and future fishing activity, it would not be a significant threat to boat anchoring and use of most fishing gear.

The proposed cable would be protected from contact with fishing gear by armoring and burial in the sea bed. Further, fishermen would not be held liable if they damage the cable (whether the damage occurs during the cable's operational life or after abandonment) while using traditional fishing methods and gear, unless such damage is intentional or egregious. In addition, should a fisherman's gear become snagged on the cable and be sacrificed, the applicant would reimburse the fisherman for the gear, provided that timely notice is given and that appropriate evidence is provided to show that the gear was sacrificed to avoid further damage to the cable (Earth Tech 1999).

Cable Installation

The installation and operation of the cable are expected to have no significant effect on recreational fishing activities. All appropriate navigation regulations and precautions would be followed to ensure that recreational fishery vessels are not impeded during the short period of cable installation.

During installation, the applicant would take a number of actions to ensure that operators of recreational fishing vessels, as well as other users of the sanctuary, are fully aware of the installation. Such actions would include:

- Deploy patrol vessels in high-traffic areas

- Conduct a public awareness program (initially undertaken in the initial stages of the project - would continue after installation)
- Formal notices to mariners
- Air VHF broadcasts during installation period
- Publish notices of interest to commercial and recreational fishermen in appropriate periodicals
- Provide representatives of fishing interests with opportunities to be present on board the installation vessel (as was done during the route survey)

If NOAA approves an authorization and a special use permit for the Preferred Alternative, the applicant hopes to begin installation in June 2000 to accommodate fisheries by avoiding the primary lobster season (360networks, inc. 2000a).

Operation and Maintenance

Operation of the cable would have no effect on recreational fishing vessels because the cable would be buried in the sea bed. Performance of maintenance activities would be preceded by notification of the operators of recreational fishing vessels, as discussed above.

4.1.4.5 Bird Watching, Recreational Boating, and Diving

Cable Route

The Stellwagen Bank NMS is an important site for participation in a number of recreational activities, including bird watching, recreational boating, and diving. The Preferred Alternative route is expected to have no effect on such activities.

Cable Specifications

Since the cable would be buried at a depth of 1.5 m, once installed, it would have no effect on any recreational activities undertaken in the project area.

Cable Installation

Installation of the cable is not expected to have any significant effect on recreational activities in the sanctuary. In areas that are heavily used for such activities, it is possible to install a cable by working closely with other mariners and requesting a small (2 mi) moving corridor around the cable ship in which ship traffic is restricted. The restriction could affect recreational activities for a day or two as the cable is installed in the vicinity of such activities. Some temporary loss of boating area in the vicinity of the cable-laying vessel would be necessary to secure the umbilical and equipment towed behind the ship. The applicant would work with the boating community to keep mariners informed of the schedule for cable-laying operations.

Operation and Maintenance

Operation of the cable is expected to have no effect on recreational activities. In the unlikely event that maintenance of the cable becomes necessary, the performance of maintenance activities would be preceded by notification of other mariners, as discussed above.

4.1.5 Cultural and Historical Resources

Cable Route

During the planning process, Dr. Warren Riess conducted a study of historical records and secondary sources to identify known historic maritime cultural resources in the vicinity of the Preferred Alternative route (Reiss 2000). Dr. Riess and Ocean Surveys, Inc. also completed a survey by remote sensor of the possible impact area and analyzed the resultant data against data from a side-scan sonar survey previously acquired by the applicant for geophysical planning. The study found no cultural or historical resources located within 100 ft of either side of the centerline of the proposed cable route.

The study of historical resources conducted by Dr. Reiss did identify several shipwrecks in the region, although none are located within the 200 ft wide corridor centered on the proposed cable route. Only if the installation of the cable strays outside the 200 ft corridor examined by Dr. Reiss could the installation have any effect on these shipwrecks. However, because of the methods of installation and the use of navigational equipment, including global positioning systems and sonar, it is highly unlikely that the installation would stray outside the 200 ft corridor.

Cable Specifications

Since the cable would be buried at a depth of 1.5 m, once installed, it would have no effect on any cultural or historical resources in the project area.

Cable Installation

Due to the lack of any identified cultural or historical resources along the Preferred Alternative route, no impacts are anticipated.

Obstacles found along the route outside the boundaries of the sanctuary were avoided in the design of the cable routing. In addition, the sea plow is equipped with obstacle-avoidance sonar that continuously scans the terrain up to 200 meters ahead of the plow; therefore, the route can be altered if obstacles are detected.

Operation and Maintenance

Any operation and maintenance activities that might be necessary in the future would not affect any known cultural or historical resources, since there currently are no such resources in the vicinity of the Preferred Alternative route. However, cultural and historical resources may be found in the vicinity of the cable in future years. Therefore, any operation and maintenance activities would be preceded by a detailed study to determine whether any cultural or historical resources were located in the vicinity of the area in which those activities would take place.

4.1.6 Lifecycle Assessment and Cumulative Effects on Stellwagen Bank National Marine Sanctuary

Life-Cycle Issues

The Hibernia cable is designed for a life expectancy of 25 years. There are three possible options for the cable when it has been determined that the cable is at the end of its useful life for commercial purposes. The cable could be donated to the scientific community, it could be left in place, or it could be removed. The determination of the best option would be made at the end of the project life, in order to consider conditions that may be present after 25 years. Additionally, technological advances might make cable removal easier and less environmentally intrusive. Such determination will be made by the Superintendent of the Stellwagen Bank NMS.

At the end of the project's useful commercial life, the applicant would conduct a survey of the cable route to assess status of the cable and nearby benthic habitat. It is estimated that within two years after cable burial, benthic organisms would have re-colonized most areas disturbed by cable installation. After 25 years of burial, benthic communities will have colonized other areas in and near the cable route that have favorable conditions, and abandoned areas that are less favorable. Such conditions can be expected to change over a 25-year period, based on water depth, temperature, salinity, sediment suspension, access to food, fishing, and other factors. Therefore a survey prior to a decision on removal or leaving the cable in place would be necessary.

At the end of the cable's service, the permit holder shall provide notification in writing to the Stellwagen Bank NMS Superintendent that the cable will no longer be used for commercial purposes. The permit holder shall then perform a survey of the cable route and provide a report to the Superintendent describing the status of the cable (including burial depth) and benthic communities along the cable route. The permit holder shall then prepare an evaluation of leaving the cable in place or removal of the cable. This report, to be provided to the Superintendent, shall include: 1) a full description of removal procedures; 2) a description of the type and frequency of monitoring operations, if the cable were to be left in place; 3) a complete evaluation of the environmental effects of both approaches; and 4) other potential approaches.

The removal process would likely require the use of an ROV using water jets to fluidize sediments over the cable, to the buried depth of approximately 1.5 m. The ROV jetting method would liquefy the substrate above the cable to the burial depth. The jets would be required along the entire length of the approximately 19.5 km of cable buried in the Stellwagen Bank NMS. After the cable had been unburied, a grapnel would be used to grasp the cable and bring it to the surface. Portions of the cable that were outside of the Sanctuary might perhaps be split off.

Fluidization of sediments to a depth of 1.5 m, along a 19.5 km corridor through the Sanctuary, would likely represent a more substantial environmental effect than would the cable burial itself. Removal of buried cable could likely have a number of impacts to benthic sediments, marine communities, and water quality. Fluidizing sediments over the buried cable would disperse marine sediments into the water column. Due to the operation of the ROV as compared to the Sea Plow VII, the amount of disturbed sediment would be somewhat larger than that disturbed during installation. Benthic communities along the route would be disturbed, with some species harmed by the amount of sediment that would be disturbed, and later deposition back onto the sea bed.

Cumulative Effects

Because the Stellwagen Bank NMS essentially spans the entrance to Massachusetts Bay, it is likely that some future cable projects designed to land in the Boston metropolitan area would be proposed to be located in the sanctuary. It is difficult to predict the exact number of cable projects that eventually may be proposed, since project information often is proprietary until shortly before the project is announced. However, on the basis of current industry trends and market requirements, it is anticipated that four additional cable projects are likely to land in the Boston metropolitan area within the next five years (Earth Tech 1999).

The future projects are expected to provide additional communication links to Europe and points along the eastern coast of the U.S. One or two of the projects might be "festoon" projects, which are unrepeatered cables that make short jumps along the coastline. A direct link down the East Coast to the Florida area is another possibility, as is another direct Atlantic crossing to Europe (Earth Tech 1999).

Given the above scenario, it is possible to predict that as many as five fiber-optic cables could be proposed for siting within the sanctuary over the next five years. The two transatlantic projects likely would follow the Preferred Alternative route described in this EA. The East Coast and festoon projects likely would have their own independent routes, which may or may not affect the sanctuary. Projects that may be routed through the sanctuary would be evaluated on a case-by-case basis to consider the cumulative effects of previous and future projects (NOAA 2000).

The current industry standard for minimum separation of ocean cables is 500 m in shallow water and two to three times water depth in deep water (whichever is greater). When there are two cables in confined areas, the spacing can be less, if so agreed by both parties involved, particularly in waters that are less than 300 m deep. The spacing is necessary to protect adjacent cables from activities associated with the installation or repair of another cable (Earth Tech 1999; 360networks, inc. 2000c). The industry standard also dictates that the route should be engineered with crossing angles as close to 90° as possible (360networks, inc. 2000b).

The cumulative effects of the location of five or more submarine cables within Stellwagen Bank NMS are the most significant of the predicted effects of the proposed project. For the proposed project, it is estimated that a total of 4.8 acres of sea bed would be disturbed; under the assumption that four additional projects of similar design will be undertaken in the next five years, the total amount of disturbed acreage would be approximately 24 acres (4.8 acres x 4 additional projects = 19.2 acres, plus 4.8 acres for this project yields a total of 24 acres for the five projects). Since future decisions about cable placement can be based on the benefits and effects of the projects proposed, the current proposed action should not set a precedent and should be judged solely on its own merits.

4.2 NORTHERN ALTERNATIVE

This section describes the environmental impacts of the Northern Alternative to the water; geologic; biological; cultural and historical; and socioeconomic resources of the project area. Note that a lesser degree of detailed information was available to support this evaluation.

4.2.1 Water Resources

Cable Route

The Northern Alternative route avoids areas of known contamination, such as those discussed in Section 3. Therefore, it is not expected that significantly contaminated soils would be encountered along the proposed route, and effects on water resources as a result of the route selection would be minimal.

Cable Specifications

The cable is constructed of optical fibers surrounded by a copper conductor and steel strength members, and is contained within a polyethylene tube that should prevent any leaching of metals into the environment. The cable for the Northern Alternative would be more heavily armored than the cable for the Preferred Alternative. Armoring of the cable is accomplished by steel wires, which are coated with a compound produced from pine tar. The compound contains no petroleum-based products and does not decompose or break down. Therefore, once installed, the buried cable would not cause in any subsequent alterations in amounts of suspended sediment or levels of water turbidity. No long-term effects on water quality as a result of the degradation of the cable system are anticipated.

Cable Installation

Discharges of sanitary waste and bilge water, minor fuel oil spills, and disposal of general debris could cause temporary, minor, local effects on water quality as a result of operation of vessels during installation of the cable. It is possible that minor amounts of petroleum products generated by normal ship operation could enter the water during installation. However, vessels would operate in accordance with the regulations of the USCG and other applicable regulations, in a manner similar to the operations of any other commercial vessel in U.S. waters.

The temporary disturbance of sediments caused by installation of the cable should have no significant effect on water quality or cause harm to marine biota through increased levels of toxicants. Because of the use of sea plow technology, rather than the more traditional cut-and-cover technology, disturbance of the sea bed and any potentially contaminated sediments would be minimal and temporary. Conditions typically associated with dredging operations, such as suspension, side-casting, or permanent removal of sediment, would be avoided. The slow speed at which the ship travels when plowing and installing cable would further minimize disturbance of sediment, and help prevent collisions with other vessels that could contribute to the discharge of contaminants such as petroleum products to ocean waters.

Operation and Maintenance

Once the cable has been installed, operation of the cable should have no effect on sediment or water quality. In the unlikely event of a cable fault, repair operations generally would necessitate unburying the cable in the vicinity of the damage and bringing it to the surface for repair. After repair, the cable would be reburied by a remotely operated vehicle. Section 2 presents a more detailed discussion of cable repair. Repair operations would cause temporary disturbance of sediment, suspension of sediment in the water column, and disturbance of benthic communities.

4.2.2 Geologic Resources

Cable Route

The potential that mining of sand and gravel will be undertaken along the Northern Alternative route may be limited because of the nature of the materials present, the depth of the water, and the potential that recovery of materials would be difficult and costly. It is not anticipated that selection of the Northern Alternative route would affect the ability to extract resources from the area.

The Northern Alternative route avoids areas of known contamination, such as those discussed in Section 3. Therefore, it is not expected that significantly contaminated soils would be encountered along the proposed route, and effects on geologic resources as a result of the route selection would be minimal.

The Northern Alternative route would be selected so that the cable could be buried in the softest bottom types to avoid unnecessary effects on the environment. Table 4-2 shows bottom types affected by length and percentage of the total Northern Alternative route.

Table 4-2: Bottom Types Along the Northern Alternative Route

Bottom Type	Length (km)	Percentage of Route (%)
Gravel (Mixed Course)	10.00	5
Sand	23.70	11
Mud	119.90	55
Mud (Silt/Clay)	66.30	30
Total	**219.90**	**100**

Source: Seafloor Surveys International, Inc. 1999. The Northern Alternative route would be approximately 104.6 km longer than the Preferred Alternative route.

Cable Specifications

The cable is constructed of optical fibers surrounded by a copper conductor and steel strength members and is contained within a polyethylene tube that should prevent any leaching of metals into the environment. The cable would be armored by steel wires and coated with a compound produced from pine tar. The compound contains no petroleum-based products and does not decompose or break down. Therefore, no long-term effects on sediment quality as the result of degradation of the cable system are anticipated.

Cable Installation

The project would involve the temporary disturbance of ocean bottom sediments to a 1-m-wide by 1.5-m-deep wedge in the sediments to bury the cable. The width of the plow is 4.6 m, including the skids. The skids “float” on the surface of the sea bed, rather that disturbing it. Therefore, the width of the area of disturbance would be the width of the plowshare (1.5 m deep and 1.0 m wide by approximately 219.9 km, or a total of approximately 54.34 acres of disturbed sea bed) (Seafloor Surveys International, Inc. 1999).

Cable installation should cause only minor, local, and temporary suspension of sediment along the cable route, since the ship towing the plow would travel at a speed of only 0.5 to 1 knot and the area to be disturbed is narrow. The sediment that is disturbed is displaced sideways and upward, but would fall back into the trench immediately after the plow passes and the cable is inserted into the trench. As the sediments are disturbed, any contaminants bound to the sediments could possibly be resuspended temporarily. The temporary disturbance of sediments caused by installation of the cable should have no significant effect on sediment or water quality or cause harm to marine biota through increased levels of toxicants.

Operation and Maintenance

No long-term hydrographic events are expected to affect the cable, once installation has been completed. Normal seasonal currents currently affect the sea-floor sediments, but those currents have caused no mass removal of sediment that would suggest the cable might become exposed. Any significant events, such as hurricanes or 100-year storms, should not affect the sea-floor sediments in a manner that would expose the cable.

The storm of record in the area is the Halloween Storm of 1991. Examination of bathymetric charts from both before and after the storm shows that the sea floor has not changed to any great degree. The depth of water, coupled with the depth at which the cable will be buried, should ensure that the cable remains buried.

4.2.3 Biological Resources

The potential effects of the Northern Alternative on biological resources in the vicinity of the project area are described below. The resources discussed correspond to those presented in Section 3 and include fish; benthic communities; marine mammals, reptiles, and birds; and plankton. The effects on each resource are presented as above, by cable route, specifications, installation, and operations and maintenance.

4.2.3.1 Fish

Cable Route

Demersal fish that inhabit the cable route lay their eggs in the fall or early winter, and hatching usually occurs before spring. Installation of the cable on the U.S. portion of the route is expected to take place spring or summer 2000, after the eggs have hatched, thereby eliminating any direct effects, such as displacement of eggs.

Cable Specifications

Once installed, the buried cable is not anticipated to have any effects on fish species in the area. Because a portion of the Northern Alternative route would be unburied (1.262 km), the applicant proposes to use more heavily armored cable (see Section 2.2.2 and Figure 2-5) to protect against potential breakages. Based on this armoring, it is considered by the applicant to be very unlikely that the cable would break. In addition, breakage would not be expected to release hazardous materials into the marine environment due

to the insulating gel that further protects the cable from water ingress. See Appendix B for additional technical data on the proposed cable materials.

Cable Installation

The habitat of both eggs and adults of the species of demersal fish found in the area would be disturbed temporarily during the plowing of the 1 m wide by 1.5 m deep wedge in the sediments to bury the cable. The result should be only minor and temporary disturbance of sediment and any bottom-dwelling fish or the eggs of those fish along the route. The sediment that would be disturbed would be displaced sideways and upward, but would fall back into the trench immediately after the plow passes and the cable is inserted into the trench. The alteration of other aspects of the habitat of demersal fish species, such as loss of prey, would be local and temporary and is not expected to have any measurable effect on populations of demersal fish species. Temporary displacement of some fish from the immediate vicinity (that is, tens of feet) of the cable route would occur during operation of the plow. Those impacts also would be of a temporary and local nature.

Pelagic fish should not be affected significantly by installation of the cable. Installation of the cable in coastal waters would take less than two days. It is not expected that any minor pollution effects from the operations of ships would affect those fish species.

Operation and Maintenance

Since almost all of the Northern Alternative cable is buried permanently, the cable itself, as well as operation and maintenance of the cable, would have no long-term effects on demersal or pelagic fish species, their reproduction, or their habitat.

4.2.3.2 Benthic Communities

Cable Route

The benthic communities present along the Northern Alternative route are those associated with mixed soft-bottom areas and hard rock sea bed. Effects on those communities would be greater for the Northern Alternative than for the Preferred Alternative because a greater length of cable would be installed under that alternative.

Cable Specifications

Since nearly all of the cable would be buried at a depth of 1.5 m, once installed it is not anticipated to have effects on any benthic organisms present in the project area.

Cable Installation

Environmental effects on benthic communities would result from operation of the plow. The project would involve the temporary disturbance of ocean bottom sediments while plowing a 1-m-wide by 1.5-m-deep wedge in the sediments to bury the cable. The width of the plow is 4.6 m, including the skids. The skids “float” on the surface of the sea bed, rather that disturbing it. Therefore, the width of the disturbed

area would be the width of the plowshare (1.5 m deep and 1.0 m wide, by approximately 219.9 km, or a total of approximately 54.34 acres of disturbed sea bed) (360networks, inc. 2000a, Seafloor Surveys International, Inc. 1999). Regardless of the additional length of cable, the effects on the benthic community are considered to be not significant.

During installation of the cable, sedentary and slow-moving benthic organisms would be injured and killed. The plow blade may contact such organisms, and the wheels of the plow may crush some individuals. More mobile benthic species, such as groundfish, lobsters, and crabs, would be expected to avoid direct contact by moving out of the way of the sea plow (NMFS 2000, Earth Tech 1999).

Because the amount of disturbance of soil required for installation is minimal and the disturbed area would be restored immediately to preinstallation conditions, effects on the marine environment would be minimal. In addition, installation of the cable progresses slowly, at a rate of approximately 0.5 to 1.0 knot, thereby limiting the potential that the plow would affect benthic habitats adversely. Given the narrow area of temporary disturbance of sediment, it is anticipated that much of the benthic infauna and epifauna would recolonize the area in which the cable was laid within a matter of weeks or months. In some cases, recolonization would not occur until the next spawning season.

Operation and Maintenance

It is not expected that, after installation of the cable, the project will affect marine resources or activities because the cable would be buried to a depth of approximately 1.5 m beneath the sea bed. The location of the route also would be charted to alert mariners to the presence of the cable.

Operation of the cable should not have any effects on the benthic community. In the unlikely event of a cable fault, repair operations would necessitate unburying the cable in the vicinity of the damage and bringing it to the surface for repair. After repair the cable would be reburied by a remotely operated vehicle. Repair operations would cause temporary disturbance of sediment, suspension of sediment in the water column, and disturbance of benthic communities.

4.2.3.3 Marine Mammals

Potential effects on marine mammals include ship strikes during installation, entanglements during deployment of the cable, disturbances caused by induced electrical fields, disturbances caused by cable strumming, and entanglements associated with non-buried sections of the cable (NMFS 2000; 360networks,inc. 2000b).

Cable Route

The project area provides important feeding habitat for a number of species of whale. Marine mammals are known to feed and nurse in the project area and to migrate through it.

Cable Specifications

Since nearly all of the cable would be buried at a depth of 1.5 m, once installed it is not anticipated to have effects on any marine mammals in the project area. However, NMFS has not formally evaluated the Northern Alternative and additional consultations would be required if it were to be selected.

Cable Installation

Any effects from the cable-laying ship likely would not differ from those of other vessel traffic common throughout the region. It is possible that the cable-laying ship might collide with a marine mammal along the cable route or that a marine mammal might become entangled in the cable during installation. However, it is likely that the speed of the ship during cable-laying activities would be slower than that of migrating whales or seals. NMFS concluded that, as long the speed of the cable ship during installation was no more than 1.0 knot, installation would not be likely to adversely affect endangered whales that may be present in the project area (NMFS 2000).

The potential for disturbance of marine mammals as a result of induced electrical fields was evaluated and found to be insignificant. The electrical field induced around the cable is proportional to the rate of change of current flowing through it. Since the cable carries direct current (DC) only, there is no rate of change of current, so there is no electric field around the cable, except when the cable is powered up or down. The power-up procedure typically takes several minutes, so the induced electric field is negligible.

For the Hibernia system, the current is 0.4 amp for the initial system. Ultimately, it would not exceed 0.7 amp, which is less than many household appliances (for example, a typical toaster draws 12 amps).

The intensity of the magnetic field at a distance of 1 m from the cable with a 0.7 amp current will be 0.14 micro-tesla. The intensity of the naturally occurring magnetic field at the surface of the earth ranges from 300 micro-teslas at the equator to 600 micro-teslas at the poles. Therefore, the magnetic field at a distance of 1 m from the cable is more than 2,000 times less intense than the naturally occurring magnetic field of the earth (360networks 2000b).

Operation and Maintenance

After the cable has been installed, entanglements of marine mammals would be unlikely because the cable is to be mostly buried along the Northern Alternative route. NMFS concluded that the cable would not be likely to adversely affect endangered whales if it were buried to a depth of 1.5 m beneath the sea bed. NMFS also recommended that post-deployment surveys be conducted within 30 days of the installation of the cable, and again four years after installation, to document that target depths of deployment were reached (NMFS 2000). Identification of the potential effects of unburied portions of the cable along the Northern Alternative route would require additional consultation with NMFS.

The geologic conditions present along the Northern Alternative route include rock outcroppings and crevasses. A concern related to those areas is the speed of ocean currents and their potential to cause cable "strumming." Strumming would be the result of the oscillating forces exerted on a suspended member when turbulent vortexes move past the member. Strumming could occur in a cable if a section of cable were suspended above the sea bed, and a current of sufficient velocity moved perpendicular to the cable. The frequency and amplitude of the oscillations would be a function of the suspension length, the shape of the suspended member, the velocity of current, and the natural frequency of the cable. Suspension length would be a function of the relief found along a cable route.

Burial of cable using modern slack control systems, such as those proposed for use on this project, as well as selection of a low-relief route, would provide mitigation of suspensions and strumming. Any vibration in the cable would be expected to be below the hearing range of marine mammals. Therefore, suspensions and strumming would not be expected to cause an adverse effect on marine mammals (360networks, inc. 2000b). However, NMFS has not formally evaluated the potential effects of any unburied and/or

suspended segments along the Northern Alternative route. Selection of the Northern Alternative would require additional consultations with NMFS.

In the unlikely event of a cable fault, it might be necessary to apply an electroding signal to the cable to locate the fault. If an electroding signal were applied to the cable, a low-level AC signal would be generated, with a frequency in the range of 15 to 25 Hz for the short time period necessary to locate the fault.

4.2.3.4 Marine Reptiles

Marine reptiles could be affected by the Northern Alternative route in a number of ways. Ship strikes could occur during installation of the cable, and entanglements could take place, both during deployment of the cable and after installation, if any portion of the cable is unburied (NMFS 2000).

Cable Route

The project area provides important feeding habitat for a number of species of marine reptiles. Marine reptiles are known to feed and nurse in the project area and to migrate through it.

Cable Specifications

As nearly all the cable would be buried at a depth of 1.5 m, once installed it is not anticipated to have effects on any marine reptiles in the project area.

Cable Installation

No temporary or permanent effects on marine reptile populations are likely or expected as a result of installation of the fiber-optic cable, which would not affect the habitat of those populations. There is a slight potential that marine reptiles might become entangled in the ship lines during installation of the cable, or collide with the vessel performing the installation. However, the lines are maintained fairly taut, and entanglement is unlikely. The potential for ship strikes and entanglements during deployment would also be reduced by the slow speed of the ship during installation. It is proposed that the deployment speed would be between 0.5 and 1.0 knot.

Operation and Maintenance

No temporary or permanent effects on marine reptile populations are likely or expected as a result of operation of the fiber-optic cable, which would not affect the habitat of those populations.

After installation of the cable, the potential for entanglements would be eliminated because the cable would be buried along most of the Northern Alternative route. It is recommended that post-deployment surveys be conducted within 30 days after installation of the cable, and again four years after installation, to document that target depths of deployment were reached. Identification of the potential effects of unburied portions of the cable along the Northern Alternative route would require additional consultation with NMFS (NMFS 2000).

4.2.3.5 Marine Birds

Cable Route

The area of the Northern Alternative route provides important feeding habitat for a number of species of marine bird. However, no effects on the feeding habitat of those species would be expected under the Northern Alternative.

Cable Specifications

Since nearly all of the cable would be buried at a depth of 1.5 m, once installed it would not have any effects on marine birds in the project area.

Cable Installation

No permanent effects on populations of marine birds are likely or expected as a result of installation of the fiber-optic cable. The cable is to be installed at sufficient depth that the temporary disturbance would not influence the feeding activities of either surface-feeding or diving bird species, in terms of both their spatial feeding area and their prey. Many such birds are adapted to frequenting areas used by fishing and other vessels; the presence of additional vessels during the short installation period therefore will not have a negative effect on their abundance.

There will be no temporary or permanent impacts on the one federally listed endangered bird species, the Roseate tern. The recovery plan for the tern focuses on protecting breeding colonies, but availability of prey may limit population recovery by the species. The proposed project is not expected to have an effect on the availability of prey, and therefore would have no effect on the species. However, if the cable is to installed during the months of August and September, which is the period during which the Roseate tern prepares for migration, FWS must be advised (FWS 1999).

No mitigation measures are necessary because there will be no temporary or permanent effects on marine birds as a result of installation of the fiber-optic cable under the Northern Alternative.

Operation and Maintenance

No permanent effects on marine bird populations are likely or expected as a result of operation or maintenance of the fiber-optic cable. Therefore, no mitigation measures are necessary.

4.2.3.6 Plankton

Cable Route

The area of the Northern Alternative route provides important habitat for a number of species of zoo- and phytoplankton. However, no effects on the habitat of those species would be expected under the Northern Alternative.

Cable Specifications

Since nearly all the cable would be buried at a depth of 1.5 m, once installed it is not anticipated to have any effects on any species of plankton in the project area.

Cable Installation

No temporary or permanent effects on populations of phytoplankton or zooplankton are likely or expected as a result of installation of the fiber-optic cable. The cable is to be installed at sufficient depths that the temporary disturbance will not influence the distribution or abundance of plankton. No mitigation measures are necessary, since there will be no temporary or permanent effects on plankton as a result of installation of the fiber-optic cable under the Northern Alternative.

Operation and Maintenance

No temporary or permanent effects on populations of phytoplankton or zooplankton are likely or expected as a result of operation and maintenance of the fiber-optic cable. No mitigation measures are necessary, since there will be no temporary or permanent effects on plankton as a result of operation and maintenance of the fiber-optic cable under the Northern Alternative.

4.2.4 Socioeconomic Resources

The potential effects of the Northern Alternative on the socioeconomic resources of the region are described below. The resources described correspond to those presented in Section 3: commercial fishing, commercial shipping and navigation, whale watching, recreational fishing, bird watching, boating, and diving.

It is important to note that the cost of the Northern Alternative would exceed that of the Preferred Alternative by approximately $12 million, because of the additional length of cable and additional installation time associated with the Northern Alternative.

4.2.4.1 Commercial Fishing

Cable Route

The applicant would not apply for an exclusion zone for the cable route under the Northern Alternative, although some portions of the cable would be unburied. However, the applicant would coordinate arrangements with applicable marine charting authorities to chart the unburied cable area (360networks, inc. 2000a).

Cable Specifications

To avoid interference with important commercial fisheries and the gear used by those fisheries, the cable would be heavily armored for protection against breakage and buried, whenever possible. The cable armor for the Northern Alternative would be heavier than that for the Preferred Alternative, as described

above. Since most of the cable would be buried to 1,500 m for protection against existing and future fishing activity, it would not be a significant threat to boat anchoring or use of most fishing gear, such as bottom-set long line, gillnets, and lobster pots and traps.

The proposed cable would be protected from contact with fishing gear by armoring and burial in the sea bed, whenever possible. Further, fishermen would not be held liable if they damage the cable (whether the damage occurs during the cable's operational life or after abandonment) while using traditional fishing methods and gear, unless such damage is intentional or egregious. In addition, should a fisherman's gear become snagged on the cable and be sacrificed, the applicant would reimburse the fisherman for the gear, provided that timely notice is given and that appropriate evidence is provided to show that the gear was sacrificed to avoid further damage to the cable (Earth Tech 1999).

Cable Installation

During installation of the cable, the applicant would take a number of actions to ensure that commercial fishing vessels are fully aware of the installation. Such actions will include:

- Deploy patrol vessels in high-traffic areas
- Conduct a public awareness program (initially undertaken in the initial stages of the project - would continue after installation)
- Formal notices to mariners
- Air VHF broadcasts during installation period
- Publish notices of interest to commercial and recreational fishermen in appropriate periodicals
- Provide representatives of fishing interests with opportunities to be present on board the installation vessel (as was done during the route survey)

Installation of the cable along the Northern Alternative route should take approximately six days longer than installation along the Preferred Alternative route, but should not interfere significantly with active fishery operations. Pelagic fisheries along the cable route that could be affected by the scheduling of the installation are active primarily from May through December. There should be no significant threat to boat anchoring or the use of most of the desired fishing gear. Fishermen would be notified before the cable installation, so damage to gear during installation can be avoided. The cable route would avoid the most active fishing grounds, in particular all identified scallop, clam, and quahog beds along the Northern Alternative route, insofar as possible.

Installation of the cable is not expected to effect commercial fishing, even if the installation occurs in the May to December timeframe. In areas in which marine activity is heavy, it is possible to install a cable by working closely with other mariners and requesting a small (2-mile) moving corridor around the cable ship in which fishing is restricted. Fishermen would be requested to keep their gear at least 1 mi away from the cable ship on each side and 2 mi away from the cable ship ahead and aft. Intensive liaison with fishermen using static gear such as gillnets and lobster pots would minimize any potential for conflict.

Operation and Maintenance

Bottom-trawling is the fishing method most likely to be affected by the cable, because its use is widespread and it entails a high level of effort. Further, the nature of the trawling gear entails a risk of entanglement, and the method involves penetration of the sea bed. Trawling gear penetrates, on average, 5 to 20 cm into the ocean bottom, and can be up to 55 m in width, thereby affecting a large area. Usually tows are conducted at known productive fishing grounds that have been charted and follow a narrow-range depth contour along the prevailing current pattern. Except during times of regulatory closures, trawl fishing is especially heavy on Jeffrey's Ledge, Stellwagen Bank, and Georges Bank, but it occurs in all areas of the central Gulf of Maine at some time each year.

4.2.4.2 Commercial Shipping and Navigation

Cable Route

While commercial shipping does take place in the vicinity of the Northern Alternative route, the Northern Alternative route is expected to have no significant effect on commercial shipping.

Cable Specifications

Since nearly all the cable would be buried at a depth of 1.5 m, once installed it would not have any effects on commercial shipping activities in the project area.

Cable Installation

No significant effects on commercial shipping are expected. The installation of the cable line would take place over a period of less than one week along the Northern Alternative route and should not interfere with commercial shipping lanes.

While oil spills that result from collisions of vessels are always a threat, the implementation of the Vessel Traffic Separation Scheme has minimized the potential for such collisions. Of 105 vessel casualties in the period from 1984-1988, 93 percent involved fishing vessels, and only two (less than 2 percent) involved commercial vessels (NOAA 1993, cited in Earth Tech 1999). Given the volume of commercial ship traffic in the area, there is little potential for collisions in general, and the prospects of a significant spill caused by collisions between usual traffic and the cable installation vessel during the cable installation period is even more remote.

During installation of the cable, the applicant would take a number of actions to ensure that commercial shipping organizations are fully aware of the installation. These include:

- Deploy patrol vessels in high-traffic areas
- Conduct a public awareness program (initially undertaken in the initial stages of the project - would continue after installation)
- Formal notices to mariners

- Air VHF broadcasts during installation period
- Publish notices of interest to commercial and recreational fishermen in appropriate periodicals
- Provide representatives of fishing interests with opportunities to be present on board the installation vessel (as was done during the route survey)

To maintain the security of the cable-laying operation at the stern of the ship, it is possible that commercial vessels may be hired to prevent other boats from intruding into the area. Otherwise, cable-laying is a specialized field, and it is unlikely that the local labor force would be used. Similarly, the cable-laying ship is self-contained; therefore, ancillary facilities and support for a work force, such as temporary housing and locally supplied food and clothing, are not needed.

All appropriate navigation regulations and precautions would be followed to ensure that commercial vessels are not impeded during the short period of cable installation.

Operation and Maintenance

Operation of the cable is not expected to have any effects on commercial vessels because nearly all of the cable would be buried beneath the sea bed (Earth Tech 1999). Performance of maintenance activities would be preceded by notification of the commercial shipping industries, as discussed above.

4.2.4.3 Whale-Watching

Cable Route

The project area provides important habitat for a number of species of whale. Consequently, vessels of the whale-watching industry frequently visit the area. The Northern Alternative route is expected to have no effect on the whale-watching industry.

Cable Specifications

Since nearly all of the cable would be buried at a depth of 1.5 m, once installed it would have no effect on the whale-watching industry in the project area.

Cable Installation

Installation of the cable is not expected to have any significant effect on whale-watching in the project area, even if installation takes place in the primary whale-watching season, from May through July. In areas in which marine activity is heavy, it is possible to install a cable by working closely with other mariners and requesting a small (2-mile) moving corridor around the cable ship in which ship traffic is restricted.

Operation and Maintenance

Operation of the cable is expected to have no effect on the whale-watching industry. In the unlikely event that cable maintenance becomes necessary, the performance of maintenance activities would be preceded by notification of commercial shipping industries, as discussed above.

4.2.4.4 Recreational Fishing

Cable Route

The applicant would not apply for an exclusion zone for the cable route in the Northern Alternative route, although some portions of the cable would be unburied. However, the applicant would coordinate arrangements with applicable marine charting authorities to chart the unburied cable area (360networks, inc. 2000a).

Cable Specifications

The cable would be armored for protection against breakage and buried along nearly the entire Northern Alternative route. Since nearly all of the cable (out to the 1,500 m contour) would be buried for protection against existing and future fishing activity, it would not be a significant threat to boat anchoring or use of most fishing gear.

The proposed cable would be protected from contact with fishing gear by armoring and burial in the sea bed wherever possible. Further, fishermen would not be held liable if they damage the cable (whether the damage occurs during the cable's operational life or after abandonment) while using traditional fishing methods and gear, unless such damage is intentional or egregious. In addition, should a fisherman's gear become snagged on the cable and be sacrificed, 360networks, inc. would reimburse the fisherman for the gear, provided that timely notice be given and that appropriate evidence be provided to show that the gear was sacrificed to avoid further damage to the cable (Earth Tech 1999).

Cable Installation

The installation and operation of the cable are expected to have no significant effect on recreational fishing activities. All appropriate navigation regulations and precautions would be followed to ensure that recreational fishing vessels are not impeded during the short period of cable installation.

During installation of the cable, the applicant would take a number of actions to ensure that operators of the recreational fishing vessels are fully aware of the installation. These include:

- Deploy patrol vessels in high-traffic areas
- Conduct a public awareness program (initially undertaken in the initial stages of the project - would continue after installation)
- Formal notices to mariners
- Air VHF broadcasts during installation period

- Publish notices of interest to commercial and recreational fishermen in appropriate periodicals
- Provide representatives of fishing interests with opportunities to be present on board the installation vessel (as was done during the route survey)

Operation and Maintenance

Operation of the cable would have no effect on recreational fishing vessels because nearly all of the cable would be buried in the sea bed. Performance of maintenance activities would be preceded by notification of other mariners, as discussed above.

4.2.4.5 Bird Watching, Recreational Boating, and Diving

Cable Route

The project area is an important site for participation in a number of recreational activities, including bird watching, recreational boating, and diving. However, the Northern Alternative route is expected to have no effect on such activities.

Cable Specifications

Since nearly all of the cable would be buried at a depth of 1.5 m, once installed it would have no effect on any recreational activities undertaken in the project area.

Cable Installation

Installation of the cable is not expected to have significant effect on recreational activities in the project area. In areas that are heavily used for such activities, it is possible to install a cable by working closely with other mariners and requesting a small (2-mile) moving corridor around the cable ship in which ship traffic is restricted. This restriction could affect recreational activities during installation of the cable in the vicinity of such activities. Some temporary loss of boating area in the vicinity of the cable-laying vessel would be necessary to secure the umbilical and equipment towed behind the ship. The applicant would work with the boating community to keep mariners informed of the schedule for cable-laying operations.

Operation and Maintenance

Operation of the cable is expected to have no effect on recreational activities. In the unlikely event that maintenance of the cable becomes necessary, the performance of maintenance activities would be preceded by notification of other mariners, as discussed above.

4.2.5 Cultural and Historical Resources

Cable Route

The Northern Alternative route has been designed to avoid charted wrecks, and the ocean floor would be surveyed before construction begins to confirm that all would be avoided (Earth Tech 1999). Only a review of available sources was conducted for the Northern Alternative route. Therefore, formal route surveys, as well as SHPO consultations would likely be required if this alternative were to be selected.

Cable Specifications

Since nearly all of the cable would be buried at a depth of 1.5 m, once installed it would have no effect on any cultural or historical resources found in the project area.

Cable Installation

Obstacles found along the Northern Alternative route were avoided in the design of the cable routing. In addition, the sea plow is equipped with obstacle-avoidance sonar that continuously scans the terrain up to 200 meters ahead of the plow; therefore, the route can be altered if obstacles are detected.

Operation and Maintenance

Any operation and maintenance activities that might be necessary in the future would not affect any known cultural or historical resources, since the Northern Alternative route would be designed to avoid those resources, once they have been identified by a survey of the ocean floor. However, additional cultural and historical resources may be found in the vicinity of the cable in future years. Therefore, any operation and maintenance activities would be preceded by a detailed study to determine whether any cultural or historical resources were located in the vicinity of the area in which those activities would take place.

4.2.6 Lifecycle Assessment and Cumulative Impacts to Stellwagen Bank National Marine Sanctuary

The Hibernia cable is being designed for a life expectancy of 25 years. Traditionally cables are left in place after their commercial life. Nearly all of the cable along the Northern Alternative route would be buried, and only a short segment would be exposed on the sea bed. If left in place, the applicant has stated that the cable may be donated to the scientific community for monitoring of sea bed instruments (360networks, inc. 2000a). Resurvey and/or removal requirements may be imposed as a condition of authorization or approval by cognizant agencies.

It is likely that some future cable projects designed to land in the Boston metropolitan area would be located in the vicinity of the Northern Alternative route. It would be quite difficult to predict the exact number of cable projects that eventually may be proposed, since project information often is proprietary until shortly before the project is announced. However, on the basis of current industry trends and market requirements, it is anticipated that four additional cable projects are likely to land in the Boston metropolitan area within the next five years (Earth Tech 1999).

The future projects are expected to provide additional communication links to Europe and points along the eastern coast of the U.S. One or two of the projects might be "festoon" projects, which are unrepeatered cables that make short jumps along the coastline. A direct link down the East Coast to the Florida area is another possibility, as is another direct Atlantic crossing to Europe (Earth Tech 1999).

The current industry standard for minimum separation of ocean cables is 500 m in shallow water and two to three times water depth in deep water (whichever is greater). When there are two cables in confined areas, the spacing can be less, if so agreed by both parties involved, particularly in waters that are less than 300 m deep. The spacing is necessary to protect adjacent cables from activities associated with the installation or repair of another cable (Earth Tech 1999; 360networks, inc. 2000c). The industry standard also dictates that the route should be engineered with crossing angles as close to 90° as possible (360networks, inc. 2000b).

The cumulative effects of the location of five or more submarine cables in the vicinity of the Northern Alternative route is the most significant of the predicted effects of the proposed project. For the proposed project, it is estimated that a total of approximately 32 acres of sea bed would be disturbed; under the assumption that four additional projects of similar design will be undertaken in the next five years, the total amount of disturbed acreage would be approximately 160 acres (32 acres x 4 additional projects = 128 acres, plus 32 acres for this project yields a total of 160 acres). Since future decisions about cable placement can be based on the benefits and effects of the projects proposed, the current proposed action should not set a precedent and should be judged solely on its own merits.

4.3 NO ACTION ALTERNATIVE

Because the no-action alternative does not involve the installation, operation, and maintenance of a submarine fiber-optic cable, no effects on resources in the region would occur under that alternative.